

Team Managers Representation and Classification Method Based on the System of Organizational Terms. Results of the Research

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Abstract—The purpose of this study is to present the system of organizational terms as a theoretical foundation for representation of team management, introduce non-participating, long-term observation method of team management together with online management tools and show the example of using this method to represent and classify team managers in the field of management participation. In the research 41 students took part and they were recorded by online management tools in TransistorsHead research platform. Data collected during the research let present the contribution of the proposed method into team management classification. As the examples of team manager classes there were used participative and authoritarian management styles.¹

Index Terms—The system of organizational terms, online management tools, team manager representation, team manager classification, participative and authoritarian management styles

I. INTRODUCTION

On the one hand, team managerial work has relatively stable nature [1]. On the other hand, team managers do not have the luxury of standing back or outside of a situation in which they act. They have to take actions in the context of the situation and they need to be able to identify, articulate and respond to the unexpected contingencies [2]. The contradiction between these two approaches creates a gap for the scientific question: how to distinguish classes of team managers taking into consideration different criteria?

In order to answer to this question in this paper we propose a general research method of team manager work which allows to (1) represent a team manager by managerial actions and their features, (2) collect data

about managers' actions automatically by online management tools and (3) distinguish pre-defined classes of team managers. The aims of this paper are (a) to present the system of organizational terms as a theoretical foundation for representation of team management, (b) introduce non-participating, long-term observation method of team management together with online management tools and (b) show the example of using this method to represent and classify team managers in the field of management participation.

In common research in management studies the team managers are usually distinguished and labelled by human perception [3]. However, there are disadvantages of such a method. Firstly, because of subjectivity of human perception it cannot accurately measure the managers' features which let to distinguish reliable managers' classes [4]. Secondly, this method has low efficiency since the distinguishing and labelling classes are both applied manually [5]. Thirdly, this method cannot be applied automatically during the daily work of managers [6].

Therefore, we propose a general method that can overcome these disadvantages. Particularly, by the original theoretical foundation which is the system of the organizational terms [7] it is possible to represent a team manager by team managerial actions [6]. The data on the managerial actions can be gathered by the online management tools [8]-[9] and then the analysis can be done by the pattern recognition techniques. In such a case, the proposed methodology can automatically and accurately distinguish classes of team managers. In addition, it provides more research possibilities in management science.

II. RELATED WORK

A. Traditional Representation of Team Manager Work

Besides classical managerial functions [10], there were two main views of manager work over last 50 years. On the one hand, in 1964 the concept of managerial skills was introduced [11]. Later, in 1974 Katz proposed an approach in which managerial skills represented managerial work. The managerial skill was defined as an ability to work effectively as a team manager and to build cooperative effort within the team which the manager leads [12].

The essence of a managerial skill is not about getting better at what the manager previously did, but it involves learning how to organize team members in order to increase their productivity [13]. The dominating typology of managerial skills divides skills into 3 groups: technical, interpersonal and conceptual skills [14]. One of the latest typologies of managerial skills of managers contains such needed skills as critical thinking, problem solving, an ability to organize data, conceptual thinking, evaluating ideas, persuasive skills etc [15]. In the literature there are many field research based on the concept of managerial skills [16]-[23].

On the other hand, in 1980 Mintzberg described a manager in terms of 10 managerial roles. Managerial roles are defined as areas of job activities which are undertaken by a manager. Mintzberg introduced to the management science a typology of managerial roles which contains such roles as a figurehead, leader, liaison, monitor, disseminator, spokesman, entrepreneur, disturbance handler, resource allocator, negotiator [24]. Other researchers of team management proposed other divisions of roles, such as a leader, peer, conflict solver, information sender, decision maker, resources allocator, entrepreneur, technician [25] or an explorer, organizer, controller, adviser [26]. The concept of managerial roles were used in many research projects and the results were described in the literature [27]-[31].

These two different perceptions of a nature of any manager have influenced scientists and practitioners so much, that most of research on managerial work was designed as a research either on managerial skills or managerial roles. Based on mentioned publications it is possible to draw a conclusion that managerial skills and managerial roles as traditional theoretical concepts are sufficient to describe a team manager's work. However, there are several disadvantages of such approach.

Firstly, (a) these terms still do not recognize what really a team manager does [31]. This disadvantage makes it impossible to distinguish classes of team managers with a high certainty. Secondly, (b) the result of that is a lack of stable knowledge on team managers and patterns of their behaviour which would be apart from subjectivity of researchers and research participants. Thirdly, there is also (c) a lack of knowledge representation and reasoning because of different assumptions, vocabularies, definitions and other ontological issues in team management research. The solution to these disadvantages is replacing both

dominating terms – a managerial skill and a managerial role – with one term called a managerial action which combines managerial skills and roles in one ontological item.

B. Data Collection on Manager Work

From the point of view of research methods used to collect data on manager work there are several general approaches. Firstly, qualitative and quantitative approaches. Secondly, experimental methods. Thirdly, nonexperimental methods – archival designs, direct observation, panel designs, retrospective event history, daily diary studies, sequence analysis [32]-[33]. However, none of these methods gives precise and quantitative results in representing manager work and classification of managers. Every group of methods has a different level of accuracy and reliability.

However, there is a method of gathering data on manager work much more efficient than nearly all mentioned above. The essence of this approach is tracking the order of events over time [34]. This method is particularly useful when the events in question are discrete (occurred or not), and one can track the incidence of events over time, as well as the lags between events. The data for events can be placed into a bit map, which is a matrix in which rows represented ordered time periods (e.g., days) and columns represented specific events [35]. Results might show patterns, suggesting that with a given phenomenon, not all cases arrive at the same end state through the same steps and not every case arrives at the same final state [36]-[38]. In this approach in the past there were attempts of researching the meaning of time and space in managerial work, which resulted in big matrix containing managers' actions in the time domain [39]. Another version of this approach we can find in the research method called time motion study [40] used in production [41], healthcare services[42], process of physical workers [43], and at least, to some extent, in managerial work [39].

However, these attempts have several disadvantages such as (d) inconsistent ontological assumptions, (e) a lack of universalism for different areas of manager work, (f) little potential in implementing real team management automation. The solution to these disadvantages, which comes from a method of gathering data on manager work, is using online research tools which could track and record what a team manager really does. We propose the online research platform called TransistorsHead, which contains management tools for solving managerial problems. They are in the same time research tools and gather data on team manager's and team members' behaviour.

C. Pre-defined Classes of Team Managers

In management studies the most common classes of team managers very often focus on the issue of management styles and their effectiveness. Management style is a preferred way of managing people to bind diverse operations and functions together, as well as to exercise control over employees [44]-[45]. Another words management style is a recurring set of

characteristics that are associated with the decisional process of the firm or individual managers [46]-[47].

Many papers and other publications mention several kinds of management styles. It is necessary to present 3 main classical approaches to management styles. Firstly, there is the Tannenbaum-Schmidt Management Model oriented towards tasks (results) and people (relationships) [48]. Management styles according to the model are: authoritarianism, elitism, consultation, democracy. Secondly, there is Blake and Mouton Management Grid based on the two indicators of concern for people and concern of results. In this division we distinguish five classes of management styles: impoverished management, authoritarian management, relationship oriented management, balanced management, integrated management [49]. Thirdly, there is Likert's management system proposing four different types of management style: exploitive-authoritative, benevolent authoritative, consultative, participative [50]-[51].

However, the newer concept of management styles makes them more simple in meaning and introduce the division of two management styles: participative and authoritarian management style [52]-[53]. In order to present the contribution of the proposed team leaders representation method this last division of management styles will be considered in the next sections of this paper. These two management styles constitute two classes of team managers: participative and authoritarian managers.

Participative management style assumes that employees want to make decisions concerning their work. The basis for the idea of participative management is McGregor's Theory X – Theory Y [54]. Participative managers are trying to empower and reward their subordinates. They are always open to employees' participation. They also allow workers to enhance their professional skills [55]. Participative style of management fosters experimentation and risk taking [56].

The opposite style is authoritarian management. Some describe it as a paternalistic leadership [57], collectivist orientation [58] or a greater power distance between managers and employees [59]. The authoritarian style limits employee's or manager's creativity and has a negative impact on staff's motivation [60].

In the next sections we combined (1) a new representation of a team manager by managerial actions, which overcome disadvantages (a), (b) and (c), (2) an original method of gathering data on manager work decreasing disadvantages (d), (e) and (f), and we distinguished two classes of team managers who took part in the research by the criteria of participation.

III. REPRESENTATION AND CLASSIFICATION METHOD

A. Managerial Actions as a Representation of Team Manager Work

The answer to the question about what a team manager does seems to be hidden in the relation between managerial roles and managerial skills, because it is said, in order for a manager to play managerial roles, they should have some managerial skills [17]. It results in

understanding playing managerial roles within their managerial skills by day-to-day activities of managers effects in the managerial actions, which these managers make. Therefore, the managerial action can be defined as a real activity, which a manager does in order to play a managerial role when he has a certain managerial skill [6].

However, this definition does not imply any epistemic or practical rules how to describe such a real activity and what kind of research tools to use in order to record it somehow. The theoretical background to solve these problems is the system of organizational terms which is an original methodological concept of research in management [7]. The philosophical foundation of the system of organizational terms is based on Wittgenstein's philosophy: his theory of facts (the only beings in the world) and "states of facts" [61].

According to this approach managerial actions can be organised by events and things. Things are physical or mental ones, such as a timetable, motivation, an idea, a decision, an organizational structure, an agenda of the meeting and they are called in the system of organizational terms "derivative organizational terms". They are created by events which are short or long processes such as planning, motivating, creating, making, drawing, preparing. These processes are called primal organizational terms. There are also several other rules and arrangements which made this concept coherent and ready for practical use [7].

As it is shown in Fig. 1, when a team manager sets a goal, in a certain moment of time a managerial action occurs represented by *setting 1.1* (an event) and *goal 1.1* (a thing). Specifically, as shown in Fig. 1, each event and thing have the label *n.m*, in which *n* and *m* represent a number and a version of a thing, respectively. What is important, *Goal 1.1* has features in time, content and human relations domains.

If later (e.g. after the next managerial action – *describing 1.1* and *task 1.1*) this team manager does the next setting of the same goal, he launches the next managerial action. As the result of it the features of this goal are changed (*goal 1.1* changed into *goal 1.2*) and represent the second version of this managerial action (described by the pair of the event and the thing: *setting 1.2* and *goal 1.2*). The difference between managerial action features consisted *goal 1.2* and *goal 1.1*. let do reasoning on the events which happened in this period of time. Another words, what this team manager really did.

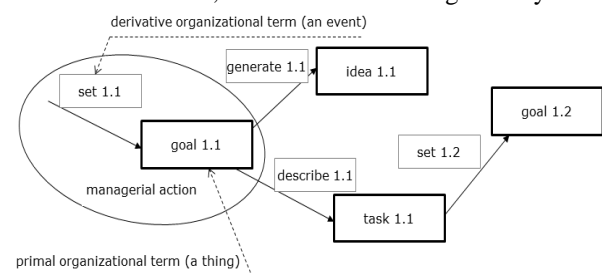


Figure 1. Fundamental structure of managerial actions

By the same token, the system of organizational terms combines the resource approach and the process approach

in the management science. It combines processes which effect in resources. In pairs they create managerial actions. As it was mentioned above, features of managerial actions are grouped in time, content and human relations domains. They show how much two managerial actions differ from one another or one managerial action differs from itself in the function of time. This enables to track a team manager by creating a map of detailed features vectors describing “who”, „what”, „when” and the „how.” [62]

This approach lets overcome the disadvantages of traditional approaches based on managerial skills and managerial roles, described in the Section 2.1. in a way that the However, in order to get data on managerial actions there is a strong need of a unique data recording method on manager work. In the Section 3.2. such a method enriched in research tools will be presented.

B. Data Collection and Research Tools

The data should be recorded in a way, which allows to represent a team manager by managerial actions, that take place in a team, which he leads. The best way of recording team managerial actions is using online management tools (as research tools) or other electronic devices, which a team manager and his team members use during day-to-day work [9]. Such innovative tools are embedded in TransistorsHead available at the website browser (transistorshead.com, trial – team: manager, username: manager, password: manager).

This platform was designed by the author of this proposed project and consists of 10 different tools to track 10 separate managerial actions, e.g. setting goals, describing tasks, checking motivation, explaining problems, preparing meetings, generating ideas. Online management tools let record all actions of team managers and team members. This methodology enables to explain „what is and what does a manager do” during teamwork and together with a team. The research tool is in the same time the management tool, which can be used either by team managers in team management or by their team members. From the theoretical point of view online management tools have such features. Firstly, according to the idea of a unit of behaviour” [63] every online management tool tracks and records one specific team managerial action. Secondly, when a team manager uses any online management tool it is equal to an event which effects in a thing, another words, equal to a process which results in a resource, respectively [9] (as it is shown in the Fig. 2). Thirdly, every management tool is designed for recording a certain team managerial action [8].

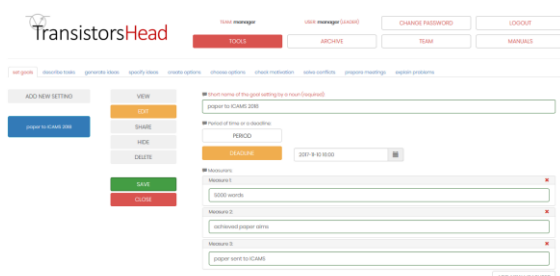


Figure 2. Goal named „paper to ICAMS 2018” being edited

Fig. 2 shows the dashboard of TransistorsHead with the example of the managerial action called SET GOALS (the name of the goal: „paper to ICAART”). It is divided into several parts. At the top where managers can choose working with tools (TOOLS default), administer members of their teams (TEAM), hide some created items (derivative organizational terms) into archive (ARCHIVE) and read instructions how to use the tools (MANUALS). There are also functions like login, logout and changing password, etc. The main menu consists of 10 different tools for team management, e.g. set goals, describe tasks, specify ideas, create options, etc. With these management tools, we can easily record each managerial action and describe it with a t-dimensional feature vector. This feature vector consists of two parts. The first one, which has a stable length, describes managerial in time domain (“when”, “who” etc.). The second part of the vector describes the content of the managerial action (especially, a derivative organizational term) answering to the wide and complex question “what” [62].

In the left of the dashboard there is the “ADD NEW” function which means that in every tool a manager can create a new item, e.g. a new goal in SET GOALS. Below this button there is a list of items created in the chosen tool, e.g. lists of goals in SET TOOLS. In the middle vertical part is the universal area containing the same buttons for every tool (VIEW, EDIT, SHARE, DELETE, HIDE). Below this area there are also universal buttons of action confirmation where a manager can save the item in the tool (the derivative organizational term) or close the tool without saving. Save confirmation uploads the data base with new data about the item, e.g. new goal parameters in the SET GOALS, and it creates the representation of a particular managerial action. In the right vertical part there is an area for forms, buttons, text areas or combo lists which a manager uses to establish the content of the tool item, e.g. a goal’s name, deadline and measures. This vertical part contains different elements for every tool depending of the designed derivative organizational term parameters.

The online management tools as research tools used together with a long-term observation of managers in a large extend eliminates disadvantages of traditional research methods described in Section II.B. Firstly, the theoretical foundation presented in Section I.A gives a background for the non-participating, long-term observation with stable ontological assumptions. Secondly, this foundation is universal and might be used to research in different areas of manager work. As it was presented in Fig. 2, TransistorsHead consisted of 10 tools according to 10 managerial actions. Thirdly, this method of gathering data on managers lets record a lot of data on their behaviour in the standardized way which is the first step for implementing pattern recognition and in results team management automation [6].

C. Classes of Team Managers

In order to check the efficiency of system of organizational terms in representation and classification of manager we conducted the non-participating, long-

term observation with online management tools in TransistorsHead. As the theoretical background we used the pre-defined participative and authoritarian styles of management, described in Section II.C. We defined (a) a class of participative team managers as managers whose behaviour belongs to the participative management style, as well as (b) a class of authoritarian team managers as managers whose behaviour belongs to the authoritarian management style.

We recorded managerial actions in 10 areas (see Fig. 2, horizontal tool menu) of team managers and team members. So that as quantitative measures of the defined class of team managers we used two simple indexes. We compared the activity of a team manager to (1) his team' activity (a total number of all managerial actions of his team members) and to (2) a single team member activity (an average of all managerial actions done by his members).

In the first case, if more than 20% of managerial actions were done by a team manager, a manager belongs to the a class of authoritarian team managers. If less than or equal to 20% of managerial action editions were done by a team manager, a manager belongs to the a class of participative team managers.

In the second case, if more than 50% of managerial actions were done by a team manager, a manager belongs to the a class of authoritarian team managers. If less than or equal to 50% of managerial action editions were done by a team manager, a manager belongs to the a class of participative team managers.

However, such a general conclusion about belonging to a management class has to be developed by the description of behaviour in particular areas. So that we distinguish 6 main managerial actions, recorded by 6 online management tools, which were equal to 6 features describing differences between participative and authoritarian styles of management [44].

That is why we also established the thresholds of these 2 management classes in every feature: 20% when we compared the activity of a team manager to his team' activity (a total number of all managerial actions of his team members) and 50% comparing the activity of a team manager to a single team member activity (an average of all managerial actions done by his members).

The connection between particular features describing differences between participative and authoritarian styles of management and managerial actions together with management tools in TransistorsHead (used as research tools) is shown in Table I.

TABLE I. CONNECTION BETWEEN FEATURES OF PARTICIPATIVE AND AUTHORITARIAN MANAGEMENT STYLES AND MANAGERIAL ACTIONS

Features of management styles	Name of a managerial action	Name of a management tool
Control	Describe task	Describe tasks
Decision-making	Choose option	Choose options
Leadership	Solve conflict	Solve conflicts
Communication	Prepare meeting	Prepare meetings
Goals	Set goal	Set goals
Motivation	Check motivation	Check motivation

Source: [44]

In Section IV.D. the features describing differences between participative and authoritarian styles of management, presented in Table I, together with results of the observation describe in details the behaviour of team managers belonging to one of the defined classes.

IV. RESULT OF RESEARCH

A. Experiment Environment

The research was attended by 41 students of the Faculty of Management at the University of Economics in Katowice. They were divided into 5-6 people teams as a part of the subject Human resources management. Each of 7 teams identified a team manager who led the team during the observation. The teams started working on May 18th 2017 at 22:18:01 (the first time one of team managers logged in) and ended on May 30, 2017 at 20:19:12 (logging out by another team manager). The study was conducted by the means of the non-participant, long-term observation. Research tools were online management tools embeded in TransistorsHead.

It should be emphasized that, from the point of view of using online management tools in TransistorsHead, which were also research tools, the team manager could create primal organizational terms (the element of managerial action, descibed in Section 2.1) in specific tools and share them with other team members. Team members could only EDIT or VIEW primal organizational terms (eg. goals) created by the team member, while they were not able to create new primal organizational terms, delete them or share them.

The task of the observed teams was to prepare a training project containing 3 training programs on 3 different subjects for the employees of the University of Economics in Katowice. Participants in the training project had to be either administrative or academic staff. As a result of the work of the participants, a pdf containing a training project was to be produced.

B. General Statistics of Team Work

In the Table II there are general statistics describing the work of all team, in particular activities of team managers and team members. As it can be seen, the duration of team managers work (from the first login to last logout in seconds) is nearly the same in all teams, however, the team members worked a different period in every team.

Despite this fact and the fact that all teams had the same main task, the most active team were team 3 and team 7. They both created more than 3500 actions in the TransistorsHead management tools. However, the number of actions in the tools were higher than managerial tools which came from the fact that not all actions, such as choosing the TOOL or TEAM function in TransistorsHead were managerial actions according to the Fig. 1. Some of the actions were only done in order to operate the management tools. That is why the real number of managerial tools for both most active teams were 2831 and 3158, respectively. The least active team created only 610 managerial actions in total.

TABLE II. GENERAL STATISTICS OF TEAM WORK

team number	type of a team member	duration of teamwork from the first login to last logout in seconds	number of any actions	number of managerial actions (any subtypes)
team 1	manager	1074469	582	175
	members	904281	1490	435
	total	x	2072	610
team 2	manager	1074686	969	292
	members	691676	930	1124
	total	x	1899	1416
team 3	manager	1007992	1738	496
	members	992927	1799	2335
	total	x	3537	2831
team 4	manager	1075398	1062	270
	members	645155	1319	1648
	total	x	2381	1918
team 5	manager	1075572	695	181
	members	905454	847	1148
	total	x	1542	1329
team 6	manager	1075612	408	143
	members	687468	582	747
	total	x	990	890
team 7	manager	1075696	1656	573
	members	798964	1917	2585
	total	x	3573	3158

The ratio of managerial actions of team managers and team members was used to designate the classes of team managers which were described in Section II.C. together with a assumed proportions in Section III.C.

C. Classes of Team Managers

As it was described in Section II.C. we assumed two ratios between managerial actions taken by team managers and team members. Firstly we compared the activity of a team manager in every team to his team's activity (a total number of all managerial actions of his team members). The results in percentage there is shown in the Fig. 3.

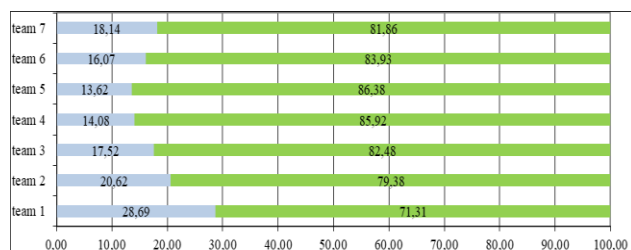


Figure 3. Ratio between managerial actions of a team manager and all team members

On the ground of assumption made in Section III.C. we can draw a conclusion that team managers of team 3, 4, 5, 6, and 7 were participative (less than 20% managerial actions of team managers, blue colour in the Fig. 3) and team managers of team 1 and 2 were authoritarian (more than 20% managerial actions of team managers).

Secondly, we compared the activity of any team manager to a single team member activity (an average of all managerial actions done by his members). In this case the we assumed the threshold at the level of 50%. And

again, team managers of team 4, 5, 6 and 7 appeared participative. The exception was a team manager of team 3 who were authoritarian, however, on the border of these two management styles. The rest team managers of team 1 and 2 remained authoritarian also in this comparison. The results are presented in the Fig. 4 (team managers – blue colour).

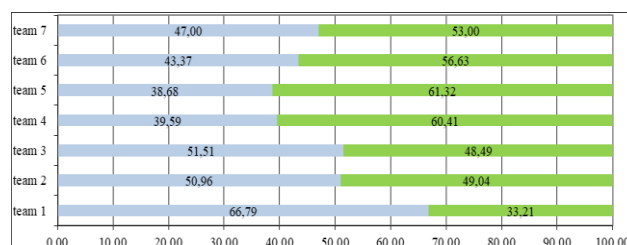


Figure 4. Ratio between managerial actions of a team manager and a single team member

D. Features of Participative and Authoritarian Managers

As it was described in Section III.C. we also distinguish 6 main managerial actions, recorded by 6 online management tools, which were equal to 6 features describing differences between participative and authoritarian styles of management. We analysed these features by ratios between particular managerial actions of a team managers and all his team members. The results in percentage for each team are presented in Fig. 5, 6, 7, 8, 9, 10 and 11 (team managers – blue colour).

Comparing the results of each team manager to one another it comes the conclusion that the individual styles of management were completely different. For example, despite the fact that team managers 1 and 2 were authoritarian, they performed differently in particular managerial actions. Team manager 1 were nearly fully authoritarian in setting goals (Goals 84,13%) and much participative in preparing meetings (Communication 23,08%). In the opposite, team manager 2 were quite participative in setting goals (Goals 41,43%) and much authoritarian in preparing meetings (Communication 70,00%). These figures are presented in Fig. 5 and 6.

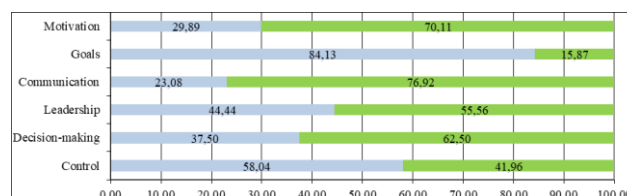


Figure 5. Ratio between managerial actions of a team manager 1 and all his team members



Figure 6. Ratio between managerial actions of a team manager 2 and all his team members

When we took into consideration the results of participative team managers from the general point of view (as it was described in Section IV.C. in Fig. 3), we also can see some differences in particular managerial actions. There are some examples. Firstly, team manager 3 was authoritarian in setting goals (Goals 54, 71% in Fig. 7) and in the management area time team manager 4 was participative (Goals 29,66% in Fig. 8). Secondly, in checking motivation team manager 7 was participative (Motivation 24,62% in Fig. 11) and team manager 4 was authoritarian (Motivation 55,72% in Fig. 8). Thirdly, team manager 4 was more authoritarian in solving conflicts (Leadership 63,64% in Fig. 8) than team manager 5 who was participative (Leadership 20,00% in Fig. 9).

However, there is one common tendency. All participative team managers, except team manager 5, were authoritarian in checking options. The results are higher than 50%. Team manager 4 is on the brink of two management styles in this management area.

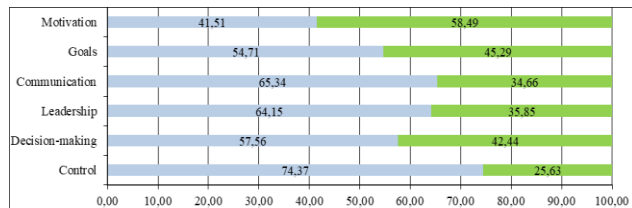


Figure 7. Ratio between managerial actions of a team manager 3 and all his team members

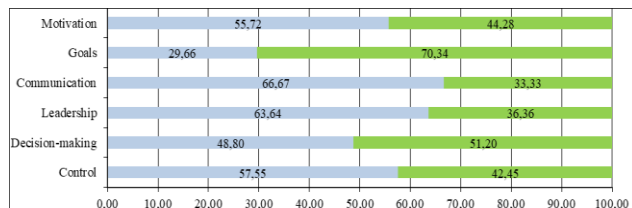


Figure 8. Ratio between managerial actions of a team manager 4 and all his team members

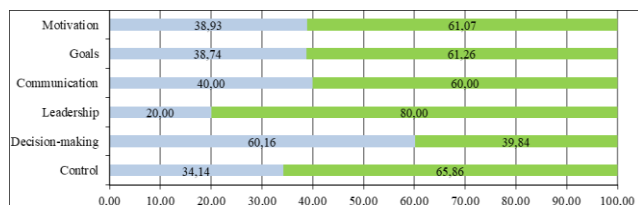


Figure 9. Ratio between managerial actions of a team manager 5 and all his team members

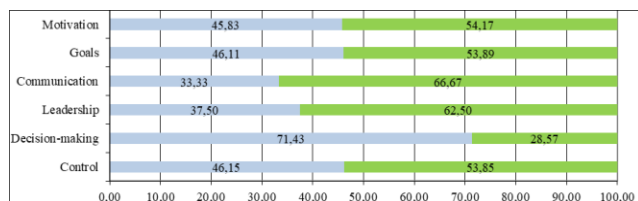


Figure 10. Ratio between managerial actions of a team manager 6 and all his team members

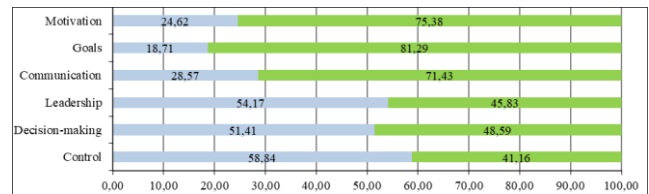


Figure 11. Ratio between managerial actions of a team manager 7 and all his team members

V. CONCLUSION

The results of the non-participating, long-term observation of team managers and team members in the field of management participation prove high efficiency of the proposed representation and classification method based on the system of organizational terms. As it was presented in Section III.A., this approach is universal and can be used not only for the field of management participation but for other areas of team management. The similar method was used in the previous research of the authors which results were presented in other publications [64].

It is worth mentioning that the idea of managerial action research by the observation was used in the past. In the literature there can be found an approach to research called time motion study [40]. However, recording team managerial actions in such an extended scale and at this level of accuracy has yet not been done before.

Additionally, more and more areas of human life are developed or replaced by machines and robots. Nowadays it seems that it is worth coming back to the similar approach of the first research in the field of scientific management, made by F. and L. Gilbreth at the beginning of 20th century [65]. They investigated human motions at work, which was the beginning of workforce automation in many industries [66]. After the first age of robotics in mechanical processes and manufacturing rapid development of computer science and Internet gives opportunities to replace team managers with robots [67].

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